

Setting the Stage: Water Quality Planning and Restoration Goals

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Tetra Tech



We know what nonpoint source pollution is, and why it's important . . .

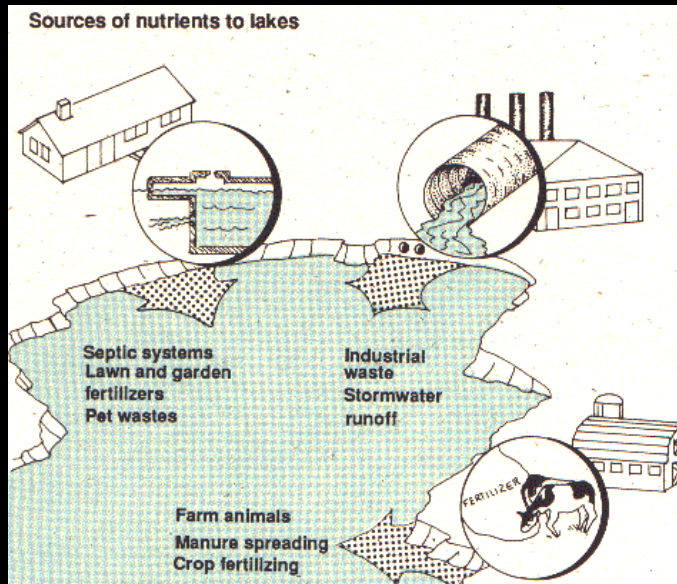
- Rainfall, snowmelt, or irrigation runs over land or through the ground, picks up pollutants, and deposits them into rivers, lakes, or the ocean or introduces them into ground water.
- NPS pollution is responsible for more than half of the nation's remaining water quality problems.
- The cumulative impact from many nonpoint sources degrades water quality.



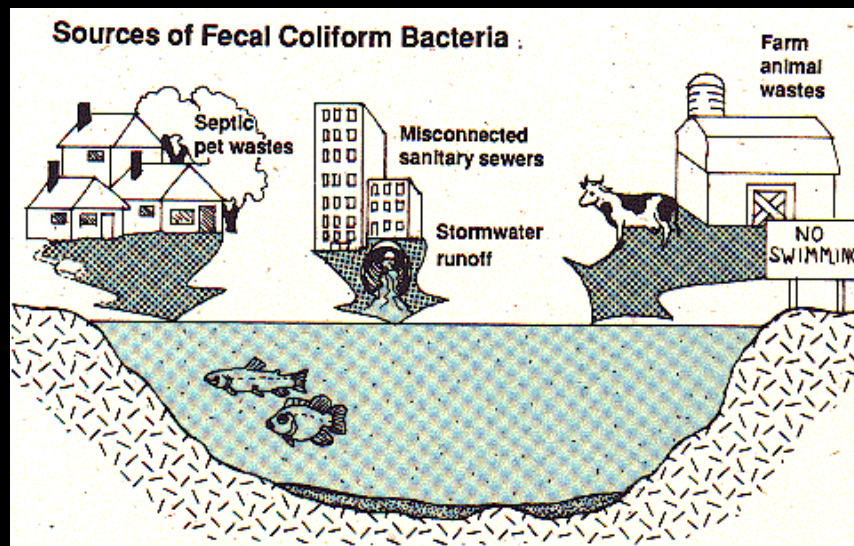
Common NPS pollutants: nutrients

NPK

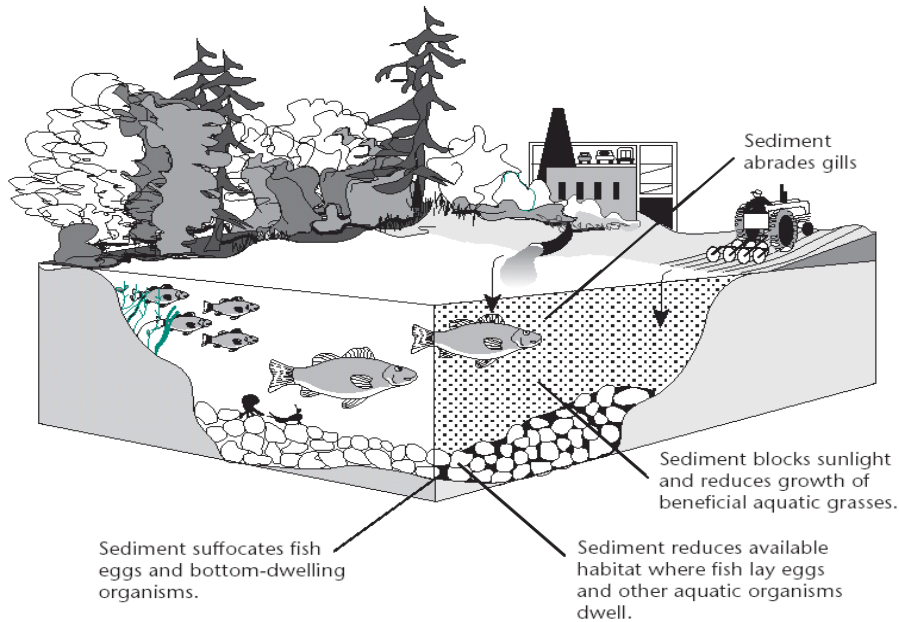
Nitrogen,
phosphorus,
and
potassium



Common NPS pollutants: bacteria

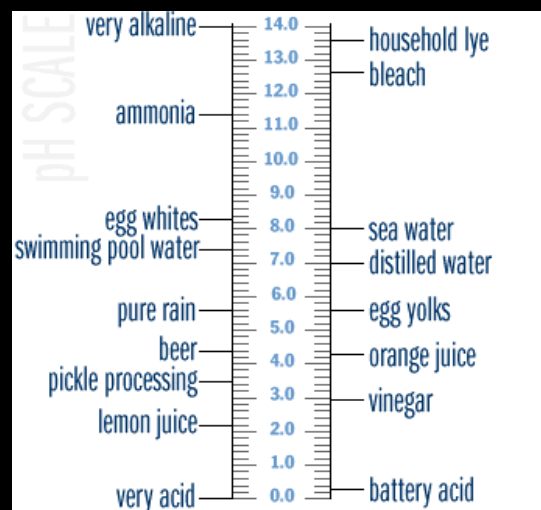


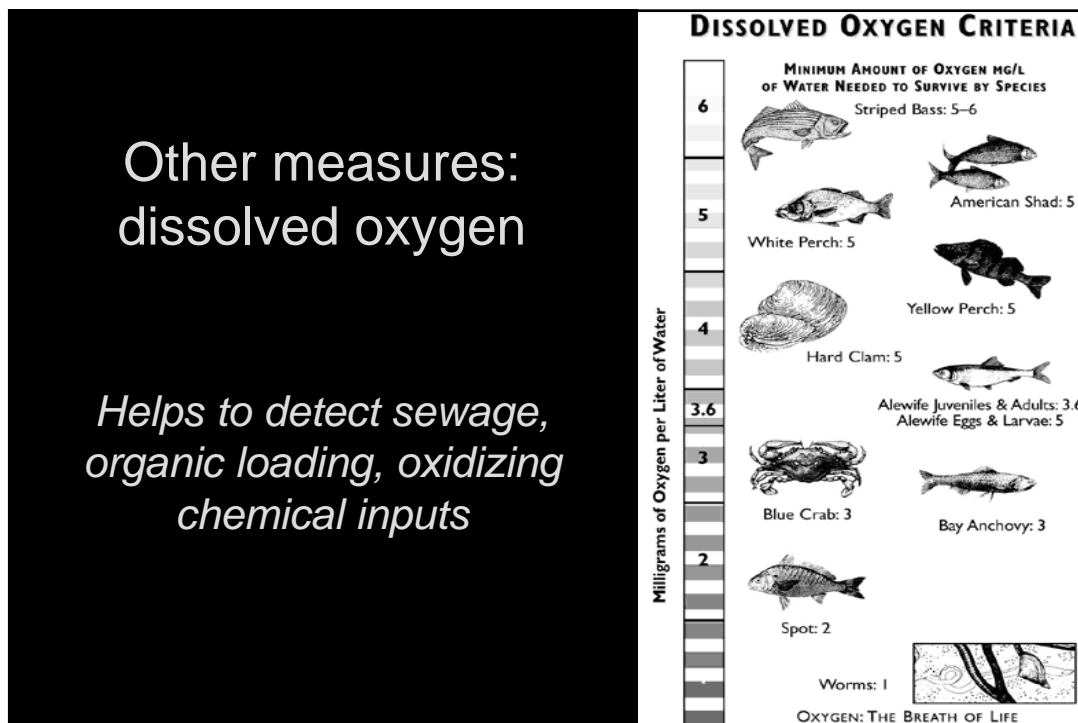
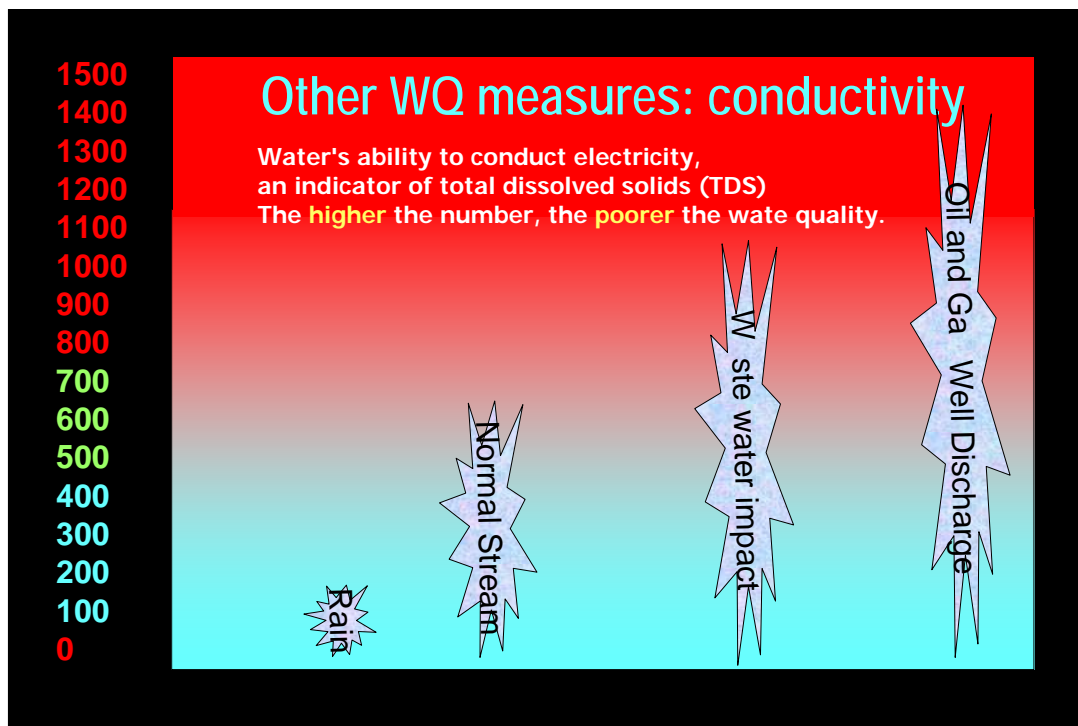
The Effects of Siltation in Rivers and Streams

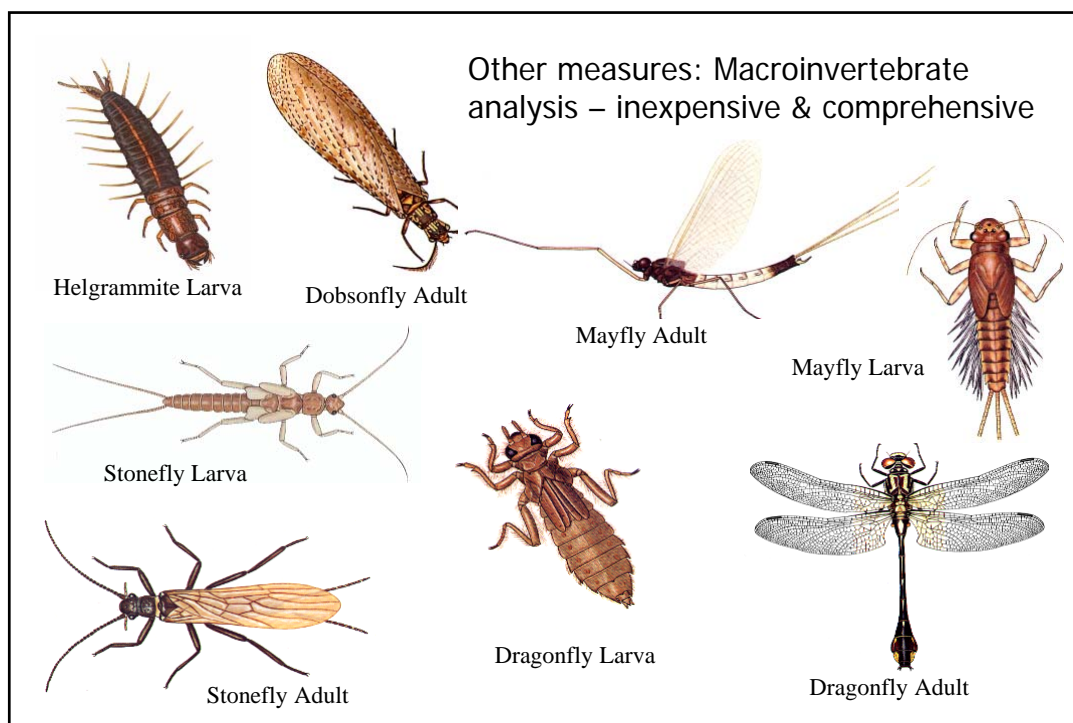


Other water quality measures: pH

- Measure of hydrogen ion concentration
- Typically 6.5 s.u. to 9.0 s.u. needed for most biota
- Determines the solubility and bioavailability of various chemicals
- Useful for detecting acid mine drainage, poor wastewater treatment



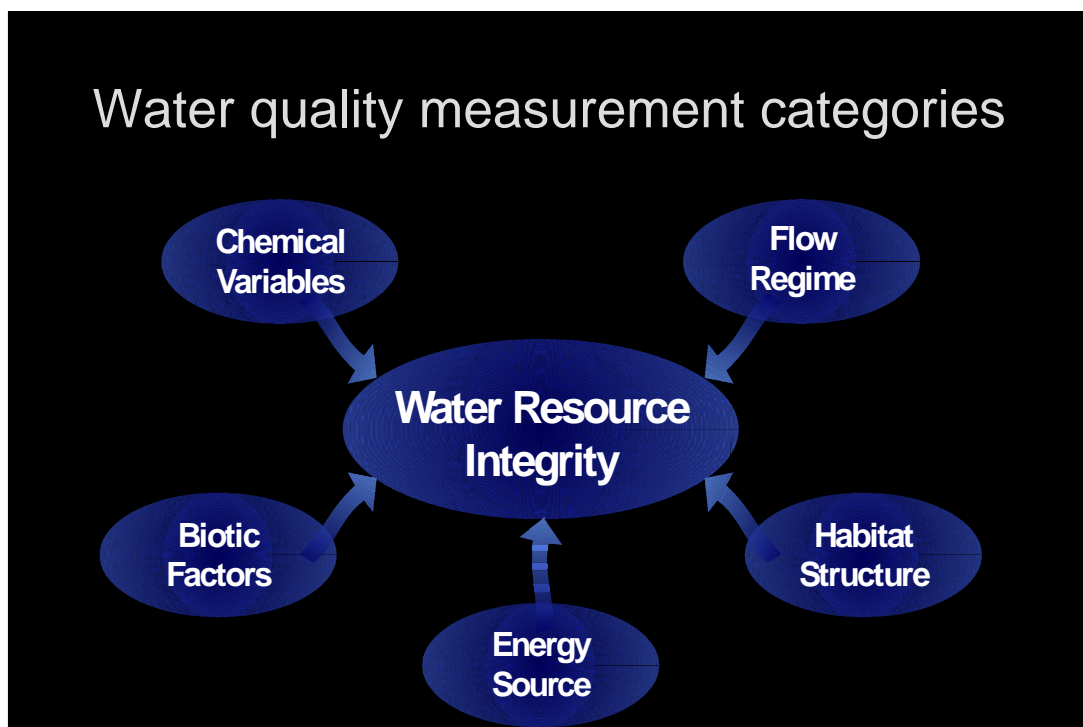


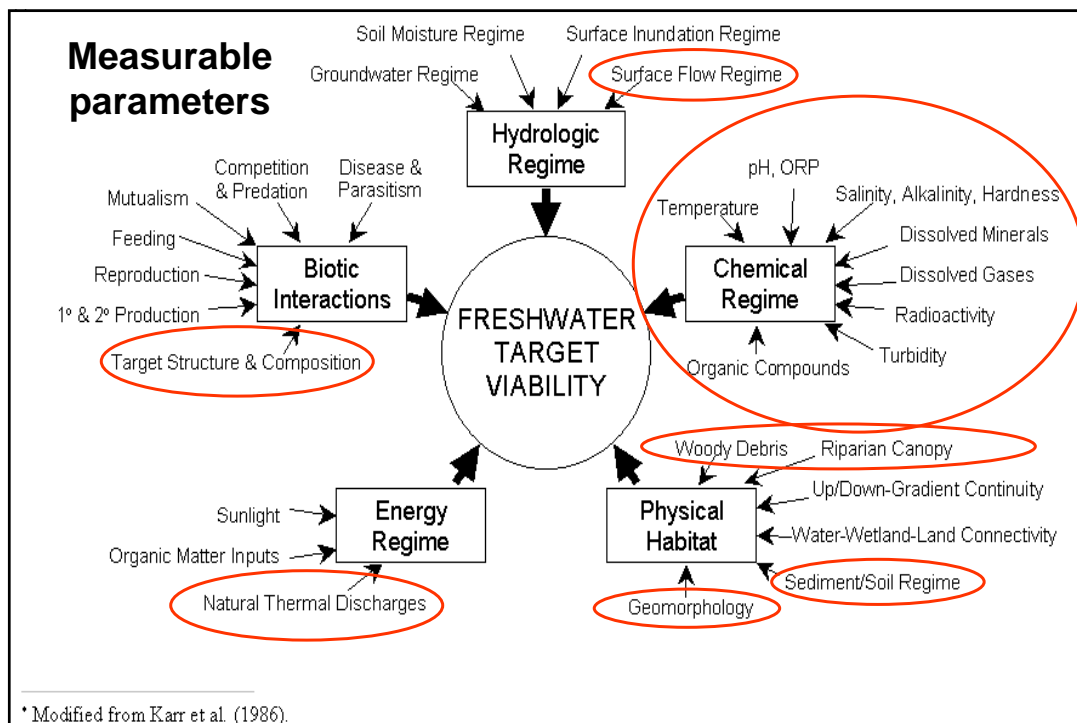
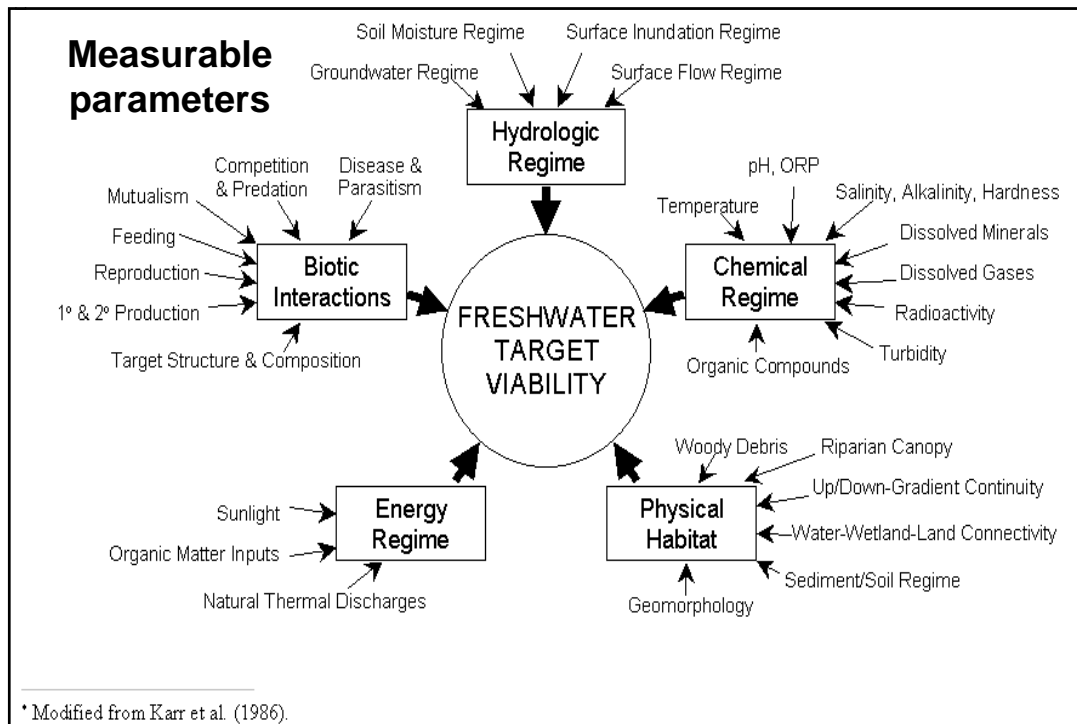


| HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT) | | | | | | | | | |
|--|--|--|--|--|--------------------------------|--|-------------------------|--|--|
| STREAM NAME _____ | | | | | LOCATION _____ | | | | |
| STATION # _____ RIVERMILE _____ | | | | | STREAM CLASS _____ | | | | |
| LAT _____ LONG _____ | | | | | RIVER BASIN _____ | | | | |
| STORET # _____ | | | | | AGENCY _____ | | | | |
| INVESTIGATORS _____ | | | | | | | | | |
| FORM COMPLETED BY _____ | | | | | DATE _____ TIME _____ AM PM | | REASON FOR SURVEY _____ | | |

| | Habitat Parameter | Condition Category | | | |
|--|--|---|---|--|--|
| | | Optimal | Suboptimal | Marginal | Poor |
| meters to be evaluated in sampling reach | 1. Epifaunal Substrate/ Available Cover | Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient). | 30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale). | 10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed. | Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking. |
| | SCORE | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |
| | 2. Pool Substrate Characterization | Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common. | Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present. | All mud or clay or sand bottom; little or no root mat; no submerged vegetation. | Hard-pan clay or bedrock; no root mat or vegetation. |
| | SCORE | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |
| | 3. Pool Variability | Even mix of large-shallow, large-deep, small-shallow, small-deep pools present. | Majority of pools large-deep; very few shallow. | Shallow pools much more prevalent than deep pools. | Majority of pools small-shallow or pools absent. |
| | SCORE | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 0 |

| | | | | |
|---|--|--|---|---|
| 8. Bank Stability (score each bank) | Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected. | Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. | Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. | Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. |
| SCORE ____ (LB) | Left Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |
| SCORE ____ (RB) | Right Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |
| 9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream. | More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. | 70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. | 50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. | Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height. |
| SCORE ____ (LB) | Left Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |
| SCORE ____ (RB) | Right Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |
| 10. Riparian Vegetative Zone Width (score each bank riparian zone) | Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone. | Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. | Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. | Width of riparian zone <6 meters; little or no riparian vegetation due to human activities. |
| SCORE ____ (LB) | Left Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |
| SCORE ____ (RB) | Right Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |





Water Quality Standards

- WQSs establish formal (legal) approaches for protecting water quality
- Key elements:
 - Designated uses – what beneficial uses apply?
 - Water quality criteria – based on designated uses
 - Antidegradation – keep clean waters clean!



WQS: Process

- WQS established by states and tribes
- EPA must review/approve prior to becoming effective
- If EPA disapproves a state or tribe WQS and state or tribe doesn't revise it, EPA promulgates a WQS
- Public review and comment at state, tribal, and federal levels (if EPA promulgates)
- States and tribes must review their WQS every three years and submit them to EPA

Indian Tribes and WQS/CWA

- Section 518 of the CWA: Under specific circumstances EPA is to “treat tribes as states” with regard to CWA programs, including:
 - Water quality standards
 - Water quality monitoring and reporting
 - TMDLs
 - NPDES
 - Various CWA grant programs



WQS: Designating Waterbody Uses

The General Rules

- Must designate all “existing” uses
- Fishable/swimmable required, with rare exceptions
- “Waste transport” not OK
- Multiple uses OK; “most sensitive use reigns”
- Can consider economic factors
- Must not preclude attainment of downstream WQS

WQS: Designated Use Categories

- Drinking Water
 - **Treated/Untreated**
- Human Contact
 - **Noncontact/Secondary/Primary (continuous)**
- Fish, shellfish consumption
- Aquatic life
 - **Warmwater species/habitat**
 - **Coldwater species/habitat**
- Agriculture Water Supply
- Industrial Water Supply
- Cultural/Ceremonial Uses

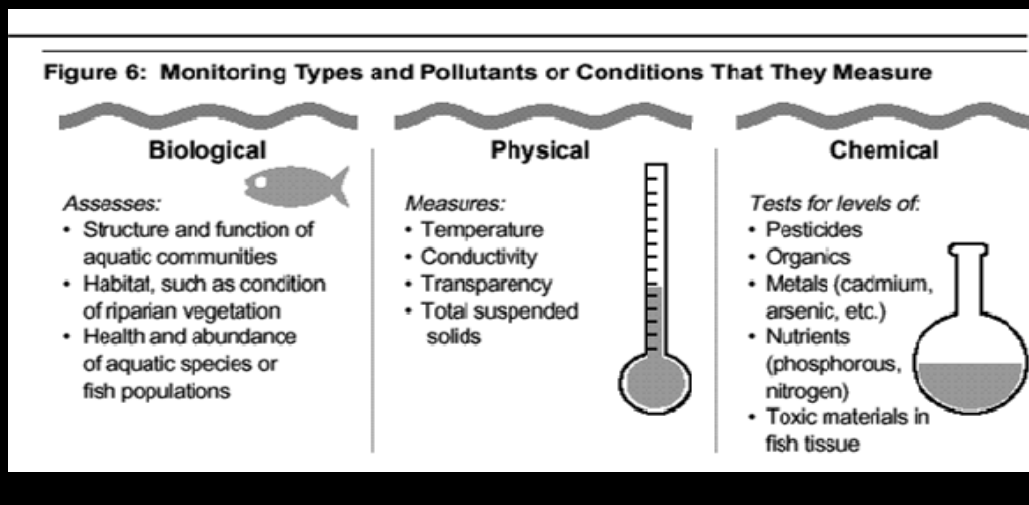


WQS: WQ Criteria (WQC)

- Consistent scientifically with protecting all designated uses (DUs)
- Basic types of criteria
 - Narrative/numeric
 - Water column/sediment/fish tissue
- Criteria can apply to:
 - Aquatic life
 - Pollutant-specific/aquatic community indices
 - Human health (drinking & fish consumption)
 - Wildlife (semiaquatic/food chain effects)



Physical, chemical, and biological factors are most often addressed by numeric or narrative water quality criteria



WQS: Narrative Criteria

- Waters must be "free from"
 - Oil, scum, and floating debris in amounts that are unsightly
 - Putrescent or otherwise objectionable bottom deposits
 - Nuisance levels of odor, color, or other conditions
 - Undesirable or nuisance aquatic life
 - Substances in amounts toxic to humans or aquatic life



Usually apply to all waters, regardless of use designation

WQS: Numeric Criteria

- **Parameter-specific: DO, temp., turbidity, N, P, Cu, dioxin, etc.**
 - Level/concentration: 1 mg/L, 5 mg/kg
 - Duration:
 - Acute: instantaneous, 1-hour, 1-day
 - Chronic: 4-day, 7-day, 30-day
 - Recurrence interval: 1 year, 3 years

WQS: Criteria for primary contact

G. CEREMONIAL USE - PRIMARY HUMAN CONTACT

Monthly *geometric mean* of fecal coliform bacteria ≤ 200 colonies/100 mL.

No individual sample may have more than 400 colonies/100 mL.

Monthly *geometric mean* for *E. coli* bacteria ≤ 126 colonies/100 mL

No individual sample may have more than 235 colonies/100 mL

$6.6 < \text{pH} < 9.0$

WQC: Aquatic Life Support

FISHERIES

| Parameter | <i>Cold Water Fishery</i> | <i>High Quality Cold Water Fishery</i> |
|----------------------------|---------------------------|---|
| Dissolved O ₂ | ≥ 6.0 mg/L | ≥ 6.0 mg/L |
| Temperature | ≤ 20°C (68° F) | ≤ 20°C (68° F) |
| pH | between 6.6 and 8.8 | between 6.6 and 8.8 |
| <i>Turbidity</i> | -- | 10 NTU |
| Conductivity (at 25° C) | -- | 300 µmhos/cm (unless <i>natural background</i> is higher) |
| Chlorine | 3 µg/L | 2 µg/L |

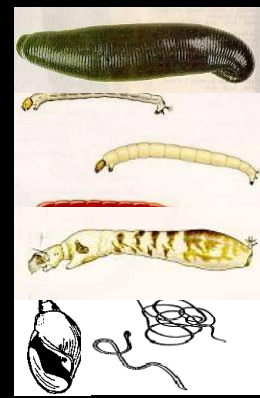
WQS: Biological Criteria



Good



Mid-Range



Poor

| MACROINVERTEBRATE TALLY | | | | | | | | |
|----------------------------|--|------|----------------------------|--|------|----------------------------|--|------|
| GROUP 1 TAXA | | CODE | GROUP 2 TAXA | | CODE | GROUP 3 TAXA | | CODE |
| WATER PENNY LARVAE | | X | DAMSELFLY NYMPHS | | | BLACKFLY LARVAE | | |
| MAYFLY NYMPHS | | | DRAGONFLY NYMPHS | | X | AQUATIC WORMS | | X |
| STONEFLY NYMPHS | | | CRANE FLY LARVAE | | | MIDGE LARVAE | | |
| DOBSONFLY LARVE | | X | BEETLE LARVAE | | | POUCH SNAILS | | X |
| CADDISFLY LARVAE | | | CRAYFISH | | X | LEECHES | | |
| RIFFLE BEETLE ADULTS | | | SCUDS | | | | | |
| OTHER SNAILS | | X | CLAMS | | X | | | |
| | | | SOW BUGS / ISOPODS | | | | | |
| Number of taxa present | | 3 | Number of taxa present | | 3 | Number of taxa present | | 2 |
| Times index value of (3) = | | 9 | Times index value of (2) = | | 6 | Times index value of (1) = | | 2 |
| Cumulative Index Value | | | | | 17 | | | |

| BIOLOGICAL QUALITY ASSESSMENT SCALE | |
|--|--|
| <div style="display: flex; justify-content: space-between; width: 100%;"> 0 5 10 15 20 25 30 </div> <div style="display: flex; justify-content: space-between; width: 100%;"> POOR FAIR GOOD EXCELLENT </div> | |

SEND REPORT FORM TO: WATER WATCH BIOLOGICAL STREAM ASSESSMENT TEAM

WQS: Antidegradation

- No activities approved that cause violation of minimum WQ criteria (Tier 1)
- If water is “cleaner” than WQ criteria, can’t degrade UNLESS important social/ economic benefits are shown; must do an alternatives analysis (Tier 2)
- Outstanding national resource waters cannot be degraded (Tier 3)

Antidegradation Overview

